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SPRUCE BUDWORM REPORT 1946

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SPRUCE BUDWORM REPORT 1946

The ability of the spruce budworm Archips fumiferana to destroy vast tracts of timber worth millions of dollars is a well known fact. At the present time thousands of acres of valuable pulp timber is being attacked by a budworm epidemic in south eastern Canda and it threatens the adjacent area in the United States. For several years prior to 1946 an infestation caused serious defoliation of Douglas-fir on the eastern slope of the Rocky Mountains in Colorado, but in 1945 and 1946 it subsided over most of the area. The factors responsible for the rise and fall of budworm population are nd well known, but studies are in progress that should add much information to the subject. Among the things that are being investigated is the effect of both native and introduced entomophagous insects on budworm populations. In Colorado during 1946 emphasis was placed upon the collection and transfer to the north eastern states of Ceromasia auricaudata and Phytodietus fumiferanae which do not occur in that area.

Methods Used to Collect the Budworm and its Parasites

Figure 1 shows the method that was used to collect approximately 62,000 budworm larvae and pupae. The collector had a small pair of prunning snips with which he cut the tip on which a larva was feeding. The tip and larva was then dropped into the can through an opening in the top. The can also had 2 openings near the bottom that were covered with fine mest wire cloth to provide light and ventilation. Four openings about 1 x 2 inches were also covered with metal cloth near the margins of the lid. In the center of the lid a round opening about 3 inches in diameter was cut and a lip about 2 inches wide was soldered around the edges so that it protruded down into the can. This lip together with the screen covered ventilation holes in the sides and lid preventing the escape of more than a few larvae. This type can suspended from the collectors neck made it possible for the collector to use both hands in his work. When a collector had filled his can with larvae infested tips the contents were emptied into trays with a wooden frame and cloth sides. The frame was tongue and groove flooring that fit together when the tray was closed so larvae could not escape. These trays were about 30 inches square and the frame on each half was 3 inches wide. The trays and their contents were taken to the laboratory at night when the collector had finished for the day. The contents of the field trays were emptied into open top trays that measured

roughly 5 x 3 x .5 feet. The larvae were prevented from crawling out of the trays by a band of tanglefoot that was placed around the inside of the tray near the top. Budworm pupae that formed in the trays from the larvae were removed and placed in pint cartons. Larvae parasitized by Phytodietus fumiferanae were isolated until after the parasite had spun its hibernating cocoon.

At first an effort was made to collect and count such parasites as Glypta fumiferanae and Apanteles fumiferanae, but this had to be abandoned because these species were not being sent east and every effort had to be directed to care for those that were being sent away before they emerged. The following were identified, packed and shipped between July 1-11 inclusive:

Ceromasia auricaudata	11,150
Madreymia saundersii	1,150
Winthemia fumiferanae	809
Phytodietus "	203
	13,312

Each of the 13,109 Larvaevorid puparia had to be handled and identified under a binocular microscope so that each species could be kept together. This proved to be a job that required long hours of sustained concentration, because an average of 1191 puparia were handled each day. A better concept of the job can be obtained by pointing out that a man handling one puparia each minute for 8 hours could only get over 480 which is less than half the number for our daily average. The writer was assisted with the identifications part of the last 3 days by Jack Hay who assisted with the field collecting, and supervised the work at the laboratory in sorting the material in the rearing trays.

The 13,312 parasites that were sent away does not include 65 Larvaevorids tentatively identified as Actia interrupta Curran, nor does it include a few Ceromasia and Madreymia that emerged the last few days of the work. It is conservative to state that less than half of the total number of parasites that emerged were sent away and on this basis it can be said that parasitism ran between 43 and 50 percent in the material collected and placed in the rearing trays. It should be mentioned that 665 field collected budworm pupae were sent directly to Canada and we did not obtain parasites from them.

Location of the Parasite Rearing Work and Assistance

The large collection of budworm larvae and pupae would have been impossible without the excellent work done by 3 high school boys, the La Veta School superintendent, and Jack Hay who is majoring in entomology at the Colorado A & M College. Dr. Wygant was able to help with the field collecting between June 18 to 25. The material was handled in the rearing trays by 5 excellent high school girls. A total of 134.5 man days were used in the preparation of rearing trays, making and sorting the collection and cleaning up afterward. This of course does not include considerable after hour work done by the writer. The assistants were all paid at the rate of $.65 per hour, and their total salaries amounted to $564.20. The official day was 8 hours and 5 days a week. The work began June 13 and terminated July 13.

Laboratory space was supplied by Forest Ranger Lewis A. Cummings in his office at La Veta, Colorado. The double car garage made an excellent place for the large rearing trays, and by raising the doors there was an abundance of light

for the girls to sort the material in the trays.

The larvae and pupae collections were made largely in 3 small drainages known as Spring, Dodgeton and Bonett Creeks. These areas were approximately 12 miles south from the village of La Veta. Two methods were tried in making the collection, one was to place sheets under large trees and beat the branches with long sticks, Larvae and pupae that fell on the sheets were put in collecting cans. The other method which was the most satisfactory was that described earlier i.e. collecting the larvae and pupae directly and dropping them into collecting cans. This method of course more or less limited the collections to small trees and the lower limbs of large trees. It is felt that larvae collected directly are not so apt to be injured as those that fall upon sheets from trees that are beat with sticks. It was also thought that such external parasites as Phytodietus might be more apt to remain on their host if the larva are collected directly. It was noted that larvae which fell on the sheets in the direct rays of the sun would frequently die before they were picked up. Under conditions where it is easy to spread the sheets and move about it may be a bit faster to collected by beating, but in general it probably is slower and it is certainly less interesting.

In the laboratory the girls worked fast and consistently in sorting the material in the trays. They placed the pupae that formed in the trays into cartons and also the puparia. Then they made daily examinations of the cartons if it were possible to do so, and removed the puparia. The puparia as mentioned previously were identified, and each species was distributed through fresh sawdust in a mailing tube and sent out on the midnight train to Pueblo where it went by plane to P. B. Dowden of the New Haven, Connecticut Laboratory. He had a temporary station at Lake Clear Junction, New York. Mr. Dowden reported that the puparia reached him in excellent condition except for the last few shipments in which some of the flies had emerged and died before they reached him. Dowden expressed high hopes of Ceromasia auricadata becoming established in the east because he said there was an abundance of fall webworm - a form that Ceromasia is known to attack as an alternate host. The Winthemia fumiferanae and Phytodietus do not emerge until spring so they did not require an alternate host in the fall of 1946 to hibernate in.

Defoliators Associated With Budworm

In the La Veta area white fir Abies concolor, alpine fir Abies lasiocarpa and Douglas-fir Psedotsuga texifolia are the hosts for budworm. White fir is the most common, and due to the foliage being heavier than that on Douglas-fir it can support a higher population of defoliators and show less injury than Douglas-fir. One defoliator associated with budworm is Dioryctria reniculella which was fairly common at La Veta, and it has been found in most areas where budworm collections have been made. D. reniculella is a host for some of the budworm parasites. The more common being Glypta fumiferanae, Apanteles fumiferanae and Ceromasia auricaudata. In 1946 a Larvaevorid tentatively identified as Pilatea colar was reared from D. reniculella, but not from budworm. A second defoliator that was observed on white fir was a small form that was sent to Washington for identification. The larvae roll the needles into a tube like arrangement and feed inside. They were fairly common but not abundant enough

to cause notable damage. Several parasites were reared from this host and have been sent to Washington for identification. A third defoliator associated with budworm has a very small moth that was seen by the thousands resting on and hovering around white fir. Specimens of the moth were sent to Washington for identification. The moths were first noted June 29 along the base of the north slope of East Spanish Peak. At that time the larvae had pupated so that no larvae were seen, but it appears that they feed on the foliage much the same as the budworm. A weevil was also noted in the area in fairly large numbers. It appeared to eat small rounded pieces from the inner margins of the needles. This species has also been sent to Washington.

Budworm Populations

A most surprising reduction in budworm populations has taken place along the eastern slope of the Rocky Mountains in Colorado. Suspicion that a reduction was pending started in the fall of 1945 when a futile search was made to find budworm eggs in the vicinity of Estes Park, Colorado. A high larval population was noted in the area during June and early July, but for some unexplained reason eggs could not be found. In the spring of 1946 an effort was made to find larvae feeding in the buds, but very few could be found, and it would have been quite impossible for a man to have collected 100 a day where 1000-2000 could have been collected with ease in 1945. A search made in the south part of Colorado where the population was extremely high in 1945 showed an enormous reduction at Buleah, San Isabel and the Indian Creek drainage near La Veta. A new infestation was found in the vicinity of La Veta in the 3 small drainages mentioned before - Spring, Bonett and Dodgeton Creeks. The larvae population in these drainages was high, but there was an abundance of food left after the larvae had pupated. An examination made July 13, showed an occasional larva, a few pupae and a few moths, but no eggs could be found. No one from the laboratory was in the area between July 14 and 25, but on July 26 and for the following 3 days a careful search was made for eggs but not a single one either hatched or unhatched could be found. A total of 5 branches from each of 90 trees were examined. Some of the branches were from trees that larvae had been taken from earlier in the month. About 20 moths were observed while the search for eggs was being made but no pupae were found. What happened to the moths is a mystery, and no satisfactory explanation is available to account for the complete lack of eggs on the material that was examined. A number of tree trunks and branches were examined for budworm hibernaculea, but none were found. The lack of eggs on the material examined is made more perplexing by the fact that a number of egg masses were deposited by moths that emerged in cartons at the laboratory. Many of the moths laid fertile eggs which hatched. It is possible that eggs were laid high in the trees where they could not be reached, but it seems questionable for them to have avoided such material as was examined. The true picture of what the population is will be available in 1947.

The budworm population appears to be fairly high on the Uncomphagre National Forest near Montrose, Colorado. Dr. Wygant also found evidence of a rather high budworm population on the Carson National Forest in northern New Mexico when he was there in the fall of 1946.

A trip was made in August with Dr. Wygant and R. C. Brown of the New Haven, Connecticut Laboratory over some of the old budworm infested areas on the Roosevelt and San Isabel National Forests on the eastern slope, and the White River and Uncomphagre on the west. The object of the trip was to acquaint Mr. Brown with areas where the budworm populations have suddenly disappeared as well as some infestations that are active. No conclusions could be made to explain the sudden reduction of the budworm populations. Plans have been formulated to collect about 25,000 budworm pupae in 1947 from the Uncomphagre and ship them via Air Express to Belville, Ontario where the parasites will be reared and sent to various points for liberation. Plans have also been made to send colonies of Compsilura concinnata from the east for liberation on the Uncomphagre and possibly some other localities such as the Carson where there are active budworm infestations.

Pine Form of the Budworm

The pine form of the budworm was more or less common in the Sugar Loaf Mountain area near Boulder, Colorado. Some of the larvae and pupae were collected and their parasites reared, some of which were sent to Washington for identification. One hundred pupae were preserved in alcohol and sent to R. N. Lejeune Officer in Charge, Forest Insect Laboratory, University of Manitoba, Winnipeg, Manitoba.

Mr. R. C. Brown suggested that a study be started at this laboratory to determine whether the pine and Douglas-fir forms of the budworm are the same species. It is hoped that work on this problem can be started in 1947.

Bark Beetle Infestations in Trees Weakened by Budworm

The ability of Douglas-fir to recuperate after being defoliated for several years was most surprising. Trees on several hillsides in the vicinity of Estes Park appeared beyond recovery in the fall of 1945 but in the fall of 1946 there was a decided greenish cast. A number of trees in these areas have died and a number of weakened trees are being attacked by Dendroctonus pseudotsuga. Time alone will tell whether the infestation will persist and spread, but at present it appears that most of the larger trees in some areas such as portions of Rocky Mountain Park will be killed. The death of trees in such places as the Park is of considerable importance, because such areas have very high scenic value.

Discussion

The sudden reduction in budworm population on the east slope of the Rocky Mountains in Colorado has emphasized the need for information to determine the factors that are responsible. There is reason to believe that entomophagous insects contributed toward the reduction, but in order to give a true evaluation of their work it will be necessary to make careful studies over a period of years to determine population trends, and the correlation between changes in budworm and parasite populations. The writer feels that in some areas it may be possible to prevent high budworm populations by the application of silviculture, and information that may be gained from a thorough knowledge of entomophagous insects. Uncontrollable factors such as weather must have a great influence on budworm population too, and should be studied in order to determine when populations may rise or fall.

Submitted by,

W. D. Buchanan

Figure 1. The most abundant budworm host in the La Veta, Colorado area is white fir Abies concolor. Budworm infested tips were cut off with small pruning snips and dropped into the collecting can.